



Ain Shams University  
Faculty of Science  
Chemistry Department

# **Development of Electrochemical Sensors Based on Electro-polymerized Materials for Determination of Some Clinically and Environmentally Relevant Species**

**A Thesis**

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا  
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ  
الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

سورة البقرة – الآية (٣٢)

# *Dedication*

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*I do appreciate my god for giving me  
great father and mother who are  
enlightening and always supporting  
me in all my life*

*I also thank my family for continuous  
encouragement and help*

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# Abbreviations

Abbreviation	Full name
<b>2-AP</b>	<i>2-Aminophenol</i>
<b>4-ABA</b>	<i>4-Aminobenzoic acid</i>
<b>4-NP</b>	<i>4-Nitrophenol</i>
<b>A</b>	<i>Surface area</i>
<b>AA</b>	<i>Ascorbic acid</i>
<b>AFM</b>	<i>Atomic force microscopy</i>
<b>AGCE</b>	<i>Activated glassy carbon electrode</i>
<b>c</b>	<i>Concentration</i>
<b>CA</b>	<i>Chronoamperometry</i>
<b>CAP</b>	<i>Chloramphenicol</i>
<b>CC</b>	<i>Catechol</i>
<b>CMEs</b>	<i>Chemically modified electrodes</i>
<b>CNTs</b>	<i>Carbon nanotubes</i>
<b>CP</b>	<i>Chronopotentiometry</i>
<b>CV</b>	<i>Cyclic voltammetry</i>
<b>CVD</b>	<i>Carbon vapor deposition</i>
<b>DA</b>	<i>Dopamine</i>
<b>DPV</b>	<i>Differential pulse voltammetry</i>

<b>D<sub>R</sub></b>	<i>Diffusion coefficient</i>
<b>EDX</b>	<i>Energy dispersive X-ray spectroscopy</i>
<b>E<sub>p</sub></b>	<i>Peak potential</i>
<b>E<sup>°</sup></b>	<i>Standard formal potential</i>
<b>FTIR</b>	<i>Fourier transform infrared spectroscopy</i>
<b>GC</b>	<i>Gas chromatography</i>
<b>GCE</b>	<i>Glassy carbon electrode</i>
<b>HPLC</b>	<i>High-performance liquid chromatography</i>
<b>HQ</b>	<i>Hydroquinone</i>
<b>I<sub>p</sub></b>	<i>Peak current</i>
<b>k<sub>s</sub></b>	<i>Apparent heterogeneous rate constant</i>
<b>LOD</b>	<i>Lower limit of detection</i>
<b>LSV</b>	<i>Linear sweep voltammetry</i>
<b>MS</b>	<i>Mass spectrometry</i>
<b>MWCNTs</b>	<i>Multi-walled carbon nanotubes</i>
<b>n</b>	<i>Number of electrons transferred</i>
<b>NPV</b>	<i>Normal pulse voltammetry</i>
<b><i>p</i>-ABSA</b>	<i>p</i> -Aminobenzene sulfonic acid
<b>PBS</b>	<i>Phosphate buffered solution</i>
<b>p-DAN</b>	<i>Poly(1,5-diaminonaphthalene)</i>



<b>PMEs</b>	<i>Polymer-modified electrodes</i>
<b>PNT</b>	<i>p-Nitrotoluene</i>
<b>R.S.D</b>	<i>Relative standard deviation</i>
<b>RC</b>	<i>Resorcinol</i>
<b>SAM</b>	<i>Self-assembled-monolayers</i>
<b>SCE</b>	<i>Saturated calomel electrode</i>
<b>SEM</b>	<i>Scanning electron microscopy</i>
<b>SFGs</b>	<i>Surface functional groups</i>
<b>SPM</b>	<i>Scanning probe microscopy</i>
<b>STM</b>	<i>Scanning tunneling microscopy</i>
<b>SWCNTs</b>	<i>Single-walled carbon nanotubes</i>
<b>SWV</b>	<i>Square wave voltammetry</i>
<b>TEM</b>	<i>Transmission electron microscopy</i>
<b>UA</b>	<i>Uric acid</i>
<b>UGCE</b>	<i>Unactivated glassy carbon electrode</i>
<b>XPS</b>	<i>X-ray photoelectron spectroscopy</i>
<b>XRD</b>	<i>X-ray diffraction spectroscopy</i>
<b><math>\alpha</math></b>	<i>Electron transfer coefficient</i>
<b><math>\nu</math></b>	<i>Scan rate</i>

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